ARS-44-171
Dairy-Herd-Improvement Letter (Vol. 41, No. 8)

November-December 1965

IMPROVEMENTS IN METHODS OF SIRE EVALUATION

Several improvements were made in the methods of sire evaluation by the USDA in 1965.

Sire Summary List

An improvement included in the February Sire Summary List was to change the schedule for using short records. Currently reported lactation records are accepted into master files and used in the sire summaries only if the interval from calving date to production-run date exceeds 364 days. The interval was tested and shown to be effective in reducing the high incidence of incomplete records in early sire summaries.

The delaying procedure will reduce the downward bias in early or initial summaries of AI 1/ bulls that was reported in a recent DHI Letter (ARS-44-148). A major factor contributing to the problem appears to be an abnormally high frequency of incomplete lactation records among daughters of bulls involved. This has been noticeably evident when sires were heavily used upon entry into AI. Rejected records were set aside and will be reentered during the appropriate quarterly sire summary.

In May, the "Predicted Difference" was first used. The predicted difference represents the expected deviation of a bull's AI progeny from herdmates in herds producing at levels near breed average, and is currently the most useful method of comparing AI bulls. It replaces the "Predicted Average" which

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1/ Artificial insemination.

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was used from December 1962 to February 1965, for AI sires, and is computed as follows:

$$\text{Predicted Diff.} = \frac{\text{No. of daus.}}{\text{No. of daus.} + 20} \text{ (Adj.dau.av. - breed av.)}$$

Thus, the only change from the predicted average is the subtraction of the breed average. With daughters scattered in many different herds, the reliability of this rating can approach maximum accuracy with a very large number of progeny. In contrast, where each bull's daughters are largely in a single herd, the accuracy of comparing sires is neither great nor materially enhanced by including more than 25 unselected progeny. The primary purpose of the predicted difference evaluation is to compare or rank AI bulls as to estimated breeding value. It is the most reliable method currently available for this purpose. It is useful to individual dairymen choosing AI sires since a given number of bulls will rank similarly in breeding value both within a herd and throughout a large number of herds.

The August Sire Summary List included several improvements, one of which is the use of new 305-day extension factors. All incomplete lactations used in current sire summaries were projected to a 305-day basis by use of these new and more complete factors. These factors allow for difference in breed, age, and milk and fat production. They were published in the August 1965 DHI Letter (ARS-44-164).

Use of a moving 2-year U.S. breed average was begun in August. Previously, the predicted difference had been calculated using a moving 5-year U.S. breed average. Consistently, the 5-year breed averages have been considerably below the production level of the herdmates of the daughters of summarized bulls. To correct this discrepancy and express the predicted differences in terms of current production levels, summaries are now being computed using the current 2-year U.S. breed average.

The values to be used through May 1966 are the average for all cows calving in 1962 and 1963 as follows:

DHIA Breed Averages 2/ (1962-63)

	Milk (Pounds)	Percent	Fat (Pounds)
Ayrshire	10,313	4.03	416
Guernsey	9,003	4.75	428
Holstein	13,059	3.64	476
Jersey	8,312	5.11	425
Brown Swiss	11,384	4.08	464
Milking Shorthorn	8,971	3.77	338
Red Dane	11,069	3.99	442
Red Poll	7,664	4.03	309

2/ Adjusted to a 2X, 305-day, M.E. (Mature equivalent) basis.

Unadjusted daughter-herdmate differences are no longer printed for bulls with sufficient AI daughters to permit the computation of predicted differences. Experience has shown that the predicted difference is superior as a measure of an AI sire's breeding merit. This will eliminate the confusion possibly resulting from two expressions of deviation in the same sire summary.

Regional breed-year-season 3/ averages were calculated to replace U.S. breed-season averages. Previously, the USDA standardized herdmate averages by using an "adjusted" herdmate (H.M.) average based on (1) the unadjusted herdmate production (2X, 305-day, M.E.), (2) the number of herdmates, and (3) the moving 5-year U.S. breed-season average:

$$\text{Adj. H.M. av.} = \text{U.S. breed-season av.} + \frac{\text{No. H.M.}}{\text{No. H.M.} + 1} (\text{Unadj. H.M. av.} - \text{U.S. breed-season av.})$$

If the mean production of all cows calving in an area in a period of time differs from the U.S. average, the adjusted herdmate averages for the corresponding lactations

3/ An average was computed for each possible combination of regions, breeds, years, and seasons (within year).

will be biased by the amount determined by the following equation:

$$\frac{\text{Regional breed-season average - U.S. breed-season average}}{\text{No. herdmates + 1}}$$

This bias will be small except where there are few herdmates and where there are large regional deviations from breed average, but they might create inconsistencies between bulls evaluated solely in one region. For example, AI bulls averaging about 20 herdmates per daughter in an area that deviates from the national average by +2,000 pounds of milk will have their evaluations over-estimated approximately 100 pounds. Rather than use a single U.S. breed average, the change uses 14 regional groupings of breed-year-season averages for Holsteins, 4 for Guernseys and Jerseys, and 3 for Ayrshires and Brown Swiss. National breed-season averages are still used for the Milking Shorthorn, Red Dane, and Red Poll breeds because of the limited number of observations available. The States included in each regional breed classification are published in the DHIA Sire Summary List for August 1965, ARS-44-165.

It is well known that the relative accuracy of AI sire evaluations increases with a greater number of daughters. The value $\frac{\text{No. of daughters}}{\text{No. of daughters + 12}}$ has been used by the USDA since 1962 as an index of accuracy for AI progeny tests. Recent studies have consistently shown observed relationships between successive proofs to be lower than those expected from theoretical computations.

A change was made in the adjustment for number of AI daughters after analyses were made by the USDA. A large sample of data representing the entire United States was used in these analyses. The sample was much more extensive than that used in previous studies. This research showed that the value $\frac{\text{No. of daughters}}{\text{No. of daughters + 20}}$ more adequately reflects the true accuracy of AI sire evaluations as measured by the group regression of future daughters on an early group of daughters. This change has the effect of placing slightly less reliability on sire evaluations based on

small numbers of progeny as shown below:

Number of daughters	New USDA regression $\left(\frac{n}{n + 20}\right)$	Old USDA regression $\left(\frac{n}{n + 12}\right)$
10	0.33	0.45
20	.50	.63
30	.60	.71
50	.71	.81
75	.79	.86
100	.83	.89
200	.91	.94
500	.96	.98
1,000	.98	.99

Cow Performance Index List

The progeny of both AI and non-AI bulls were included in the two Cow Performance Index Lists (ARS-44-160 and ARS-44-170) computed during the year. Daughters of non-AI bulls were evaluated solely on the basis of their own performance versus herdmates. In the case of AI progeny, both performance of daughters versus herdmates and performance of the sire were included in the index.

The name and address of the herd owner were included in the Cow Performance Index List if the cow was from a herd whose records were machine-processed.

4,984 SIRES SUMMARIZED IN AUGUST 1965

A total of 994 AI and 3,990 non-AI sires were evaluated in August 1965. The evaluations included 359,112 daughters with herdmates; resulted in 14,917 individual sire records, which were provided to the cooperating States; and represented 345,453 records reported since the previous summary. A summary of the number of sire records (DHIA-1202 Forms) provided to the States in August 1965 is shown in table 1.

3,650 SIRES SUMMARISED IN NOVEMBER 1965

A total of 980 AI and 2,670 non-AI sires were evaluated in November 1965. The evaluations included 249,553 daughters with herdmates and resulted in 10,893 individual sire records, which were provided to the cooperating States. Records reported since the previous summary numbered 611,332. A summary of the number of sire records (DHIA-1202 Forms) provided to the States in December 1965 is shown in table 2.

TABLE 1.--Number of sire records summarized 08-65, by State, by breed

State	Ayrshire	Guernsey	Holstein	Jersey	Brown Swiss	Shorthorn	Red Dane	Other	Red Poll	Total
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Maine	13	31	118	24	4	3	-	-	-	193
New Hampshire	26	25	127	32	9	-	-	-	-	219
Vermont	24	39	246	75	15	-	-	-	-	399
Massachusetts	29	53	209	45	15	1	-	-	-	352
Rhode Island	12	13	80	7	-	-	-	-	-	112
Connecticut	23	73	213	22	13	-	-	-	-	344
New York	44	104	599	84	30	-	1	-	-	862
New Jersey	5	69	235	28	17	-	-	-	-	354
Pennsylvania	33	176	497	61	26	5	-	-	-	798
Ohio	29	86	362	84	51	4	-	-	-	616
Indiana	13	90	254	48	36	6	1	-	-	448
Illinois	24	99	332	46	51	7	-	-	-	559
Michigan	14	63	482	43	32	7	4	-	-	645
Wisconsin	20	136	594	52	50	9	-	-	1	862
Minnesota	32	75	377	51	39	11	-	-	-	585
Iowa	36	84	371	72	46	19	-	-	-	628
Missouri	-	44	176	36	7	9	-	-	-	272
North Dakota	-	10	88	1	12	1	-	-	-	112
South Dakota	11	7	135	11	13	-	-	-	-	177
Nebraska	7	38	161	16	22	13	-	-	-	257
Kansas	29	47	221	35	20	8	-	-	-	360
Delaware	7	16	78	5	4	-	-	-	-	110
Maryland	21	69	286	18	23	2	-	-	-	419
Virginia	20	97	312	22	16	-	-	-	-	467
West Virginia	8	12	107	14	1	-	-	-	-	142
North Carolina	12	63	237	59	9	-	-	-	-	380
South Carolina	4	79	133	51	14	-	-	-	-	281
Georgia	13	31	161	35	14	-	-	-	-	254
Florida	6	66	90	51	7	-	-	-	-	220
Kentucky	5	25	181	28	11	-	-	-	-	250
Tennessee	14	65	123	71	27	4	-	-	-	304
Alabama	8	31	104	47	11	-	-	-	-	201
Mississippi	13	42	49	49	11	-	-	-	-	164
Arkansas	4	15	89	14	1	5	-	-	-	128
Louisiana	-	38	45	19	4	-	-	-	-	106
Oklahoma	13	39	140	23	8	12	-	-	-	235
Texas	9	24	179	64	8	-	-	-	-	284
Montana	2	2	43	2	4	-	-	-	-	53
Idaho	2	28	150	30	6	-	-	-	-	216
Wyoming	-	2	20	-	1	-	-	-	-	23
Colorado	4	25	124	9	16	2	-	-	-	180
New Mexico	-	18	47	14	-	-	-	-	-	79
Arizona	-	31	96	4	-	-	-	-	-	131
Utah	5	19	129	14	1	-	-	-	-	168
Nevada	-	-	21	18	1	-	-	-	-	40
Washington	16	58	169	41	8	5	-	-	-	297
Oregon	5	42	105	45	10	3	-	-	-	210
California	10	38	288	32	16	-	-	-	-	384
Puerto Rico	-	-	8	-	-	-	-	-	-	8
Hawaii	-	-	12	-	-	-	-	-	-	12
Alaska	-	-	4	-	13	-	-	-	-	17
Total sire records sent to States										14,917
Sire records summarized	175	908	2,992	624	218	62	4	-	1	4,984

TABLE 2.--Number of sire records summarized 11-65, by State, by breed

State	Ayrshire	Guernsey	Holstein	Jersey	Brown Swiss	Shorthorn	Red Dane	Other	Red Poll	Total
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Maine	8	28	91	23	5	1	-	-	-	156
New Hampshire	21	21	93	25	5	3	-	-	-	168
Vermont	17	37	160	51	11	-	-	-	-	276
Massachusetts	19	38	149	26	9	1	-	-	-	242
Rhode Island	10	15	45	5	-	-	-	-	-	75
Connecticut	13	55	132	14	11	-	-	-	-	225
New York	40	72	441	53	17	1	1	-	-	625
New Jersey	4	37	155	17	13	-	-	-	-	226
Pennsylvania	37	144	488	52	19	3	-	-	-	743
Ohio	29	83	299	92	32	4	-	-	1	540
Indiana	12	95	225	40	24	6	2	-	-	404
Illinois	17	85	261	31	29	2	-	-	-	425
Michigan	10	78	331	35	22	3	3	-	-	482
Wisconsin	12	178	504	46	45	6	-	-	-	791
Minnesota	22	56	305	32	25	7	-	-	-	447
Iowa	19	45	289	41	31	11	-	-	-	436
Missouri	-	25	122	20	6	5	-	-	-	178
North Dakota	-	6	68	1	11	1	-	-	-	87
South Dakota	14	6	79	5	9	-	-	-	-	113
Nebraska	5	39	114	13	16	4	-	-	-	191
Kansas	13	27	133	17	18	5	-	-	-	213
Delaware	5	12	56	8	2	-	-	-	-	83
Maryland	11	48	180	20	18	2	-	-	-	279
Virginia	11	73	169	26	13	-	-	-	-	292
West Virginia	10	12	74	16	1	-	-	-	-	113
North Carolina	8	51	133	29	10	-	-	-	-	231
South Carolina	3	47	77	39	10	-	-	-	-	176
Georgia	10	20	98	28	12	-	-	-	-	168
Florida	5	46	57	30	7	-	-	-	-	145
Kentucky	3	26	133	20	12	-	-	-	-	194
Tennessee	17	51	95	40	17	3	-	-	-	223
Alabama	8	21	54	29	6	-	-	-	-	118
Mississippi	12	36	42	27	8	-	-	-	-	125
Arkansas	2	16	54	6	4	4	-	-	-	86
Louisiana	-	54	46	15	4	-	-	-	-	119
Oklahoma	9	16	75	12	7	6	-	-	-	125
Texas	6	22	125	42	10	-	-	-	-	205
Montana	1	4	20	4	5	1	-	-	-	35
Idaho	6	23	85	20	4	-	-	-	-	138
Wyoming	-	3	14	-	-	-	-	-	-	17
Colorado	2	28	82	7	9	1	-	-	-	129
New Mexico	-	13	33	6	-	-	-	-	-	52
Arizona	-	24	49	2	1	-	-	-	-	76
Utah	3	16	80	12	-	-	-	-	-	111
Nevada	-	-	14	11	2	-	-	-	-	27
Washington	11	44	93	20	4	1	-	-	-	173
Oregon	4	31	53	25	2	-	-	-	-	115
California	13	36	175	33	12	-	-	-	-	269
Puerto Rico	-	-	8	-	-	-	-	-	-	8
Hawaii	-	-	4	-	-	-	-	-	-	4
Alaska	-	-	3	-	11	-	-	-	-	14
Total sire records sent to States										10,893
Sire records summarized	135	656	2,292	430	95	38	3	-	1	3,650

LACTATION RECORD REJECTS IN 1965 ARE 7.1 PERCENT OF ALL RECORDS RECEIVED AND RECONCILED IN 1965

The relative frequency of Standard DHIA lactation record rejects in 1965 by type of reject is given in table 3.

TABLE 3.--Relative frequency of Standard DHIA lactation record rejects in 1965, listed on Form 1060

Reject code	Type of reject	Percent of all records 1/	Percent of all rejects
F	Possible twin	1.5	20.5
D	Birth date	1.4	20.1
H	Identification of parents	1.1	15.9
B	Dam number, registered	1.0	14.6
A	Sire number, registered	.9	12.2
Q	Calving date	.7	9.3
M	Eartag identification	.2	3.1
R	Unusual percent test	.1	1.7
I	Cow number, registered	.1	.9
V	Days in milk, 3X exceeds 2X	(2/)	.6
J	Same identification number, cow, sire, and/or dam	(2/)	.4
T	Production	(2/)	.2
W	Identification conflict with breed association data	(2/)	.2
C	Cow, sire, and/or dam registration number, blank or alphabetic	(2/)	.2
E	Breed	(2/)	.1
G	Herd code number	(2/)	.1
P	Production, blank and/or alpha	(2/)	(2/)
	Total	7.1	100.0

1/ Includes 86,417 reconciled records.

2/ Less than 0.05 percent.